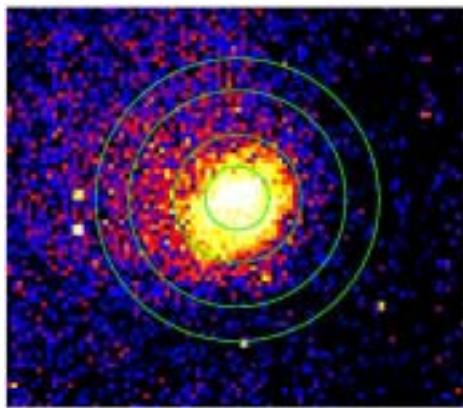


# Brightness Discontinuities and Substructure in A115

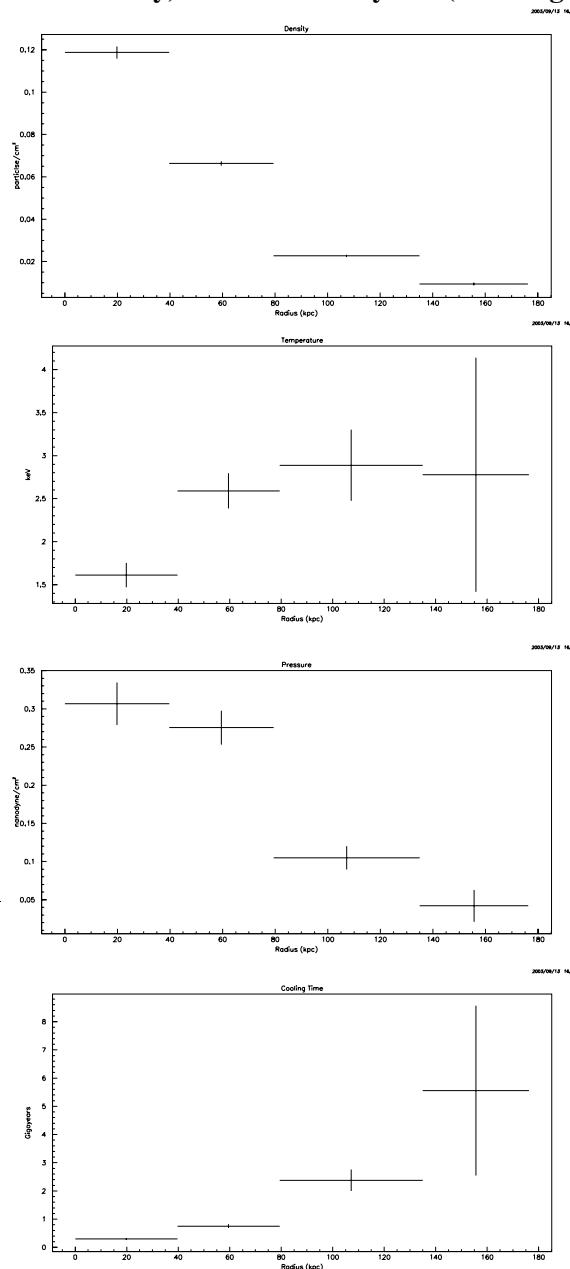
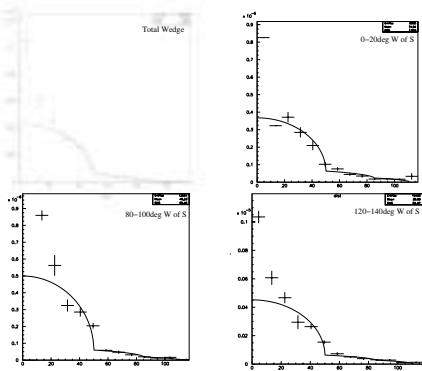
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## ABSTRACT

In an examination of the northern subcluster of A115 in a 90 kpc Chandra ACIS-I exposure we discovered several X-ray surface brightness jumps in the north western section of the subcluster. Examination of the surface brightness profiles reveals that these discontinuities are real and can be modeled with a central spike and three shells each of constant emissivity. Although the northern subcluster appears to be passing through the intra-Cluster Medium (ICM), we do not find evidence for a shock associated with any of these discontinuities. There is a pressure jump of  $1.7 \times 10^{-10}$  dyne cm $^{-2}$  between the first and second shell (innermost and next out), however there is no corresponding temperature jump, the temperature being the same ( $\sim 2.7$  keV) within both shells. These pressure jumps give an upper limit on the velocity of the inner shell of 8.89 Mach through the outer shell. The core of the cluster is significantly cooler (1.81 to 0.34 keV) than the outer shells (2.94 to 2.86 keV). The cooling time of the core (2.86 10 $^9$  years) is significantly shorter than the Hubble time, confirming the presence of a strong cooling flow. Finally, we discuss the correlation of the X-ray surface brightness distribution with the morphology of the radio galaxy 3C 28.8 at the center of the northern subcluster.



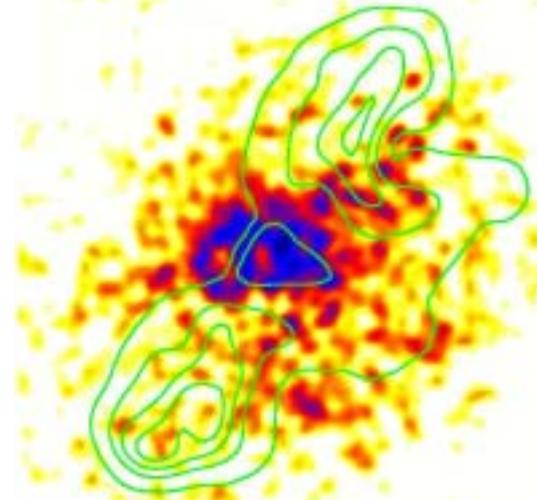
Brightness profiles were taken not exceeding the northern subcluster of A115. The 7° position, each 20 degrees wide, from 40 degrees west of north to the south had similar brightness profiles, where significant drops in brightness occur at the same distance from the center (17, 25, 42 and 44 to 28 kpc). Using a 40 degree binning of a wedge of the northern subcluster and the associated emission measure, we have made four models of the brightness profiles, and the overall profile of the regions from 40 degrees west of north to due south. The placement of the brightness drops are shown on the image above, and several profiles along with the side wedge of interest are shown below along with their accompanying models. Radiative transfer of the brightness profiles is given in transmission plastic where 1 photon/1.888 keV. Note also that the raw brightness profiles in the brightness profiles corresponding to the line replace are not fit into the model parameters.



The profiles to the left show the density temperature pressure and cooling time of the lower cluster medium as a function of radius from the center of the northern subcluster taken to be at the position of radio galaxy 3C28.

1. The density falls as would be expected as you travel further from the center of a galaxy cluster.
2. We can see from the temperature profile that it cooler that the outer two regions however the error bars are too large for us to be able to tell anything else concerning the relationship of the temperatures outside the cores.
3. The most interesting of the profiles is the pressure profile. This profile while showing as one would expect a drop in the pressure as a function of radius we also observe a very sharp drop at 80 kpc, the boundary between the innermost shell and the next one out. Based on the pressure drop across this boundary we have placed a upper limit on velocity of the inner shell through the outer shell to be 0.889 Mach. Implying that this is not a shock.
4. The cooling time increases as you move further out from the center and 3C28. It should also be noted how the cooling time in the center is significantly lower than the Hubble time confirming the presence of a strong cooling flow.

## 3C28 and Radio Contours



Above is an X-ray image of the center of the Northern subcluster of A115, radio galaxy 3C28 along with its radio contours. As one can see the bright center of the X-ray emitting region is encompassed by a central triangle in the radio contours. We do not yet know what the significance of this correlation is. No bubbles in the X-ray image were found to correspond with radio lobes of this galaxy; however we can see that the brightness of the X-ray image drops off sharply right outside X-ray lobes, where one would expect a concern to be.